Development of a leadless cardiac dual-chamber pacemaker

Background

Contemporary cardiac pacemakers monitor and control the heart's electric activity using up to three implanted leads. These leads are prone to fractures and isolation defects. The resulting surgical re-interventions may cause complications and are costly. Thus, leadless cardiac pacemakers have been introduced recently (fig. 1.). However, these devices are single-component systems and do not allow for dual-chamber pacing, although this would permit a more physiologic myocardial stimulation.

To overcome this drawback, two leadless PMs (e. g. a PM in the right atrium and right ventricle) may be implanted. These devices would need to communicate with each other by a wireless communication technology to perform synchronous dual-chamber pacing.

Our group has already built and successfully tested an own prototype of a leadless single-chamber PM. Further research aims at manufacturing a leadless dual-chamber PM using wireless communication.

Fig. 1: Leadless cardiac pacemaker (fixation at the right ventricular endocardial wall).

Aim

The aim of this project is to develop a leadless dual-chamber pacemaker.

Tasks

- To familiarize with the concept of leadless cardiac pacing and low-power wireless communication.
- Impedance measurements of myocardial tissue on a dedicated *ex vivo* test bench.
- Development of a small low-power communication module, based on the bench test results. This circuit will be implemented on a printed circuit board together with a pacemaker circuit (already existing).
- Final integration of the pacemaker circuit and the communication module into a single housing. The group will provide the opportunity for *in vivo* testing (animal trial).

Nature of the Thesis

Analytical: 20%
Experimental: 30%
Hardware development: 40%
Documentation: 10%

Requirements

Electrical engineer or biomedical engineer with strong background/interest in electronics.

What we offer

The candidate will work in a young and dynamic team of engineers and physicians, where creative and innovative work is highly appreciated. The position provides the opportunity to be involved in the development of cutting-edge cardiovascular technology and the development of active medical implants.

Supervisors

1.) Thomas Niederhauser, PhD
2.) Andreas Haeberlin, MD, PhD

Examiners

1.) Andreas Haeberlin, MD, PhD
2.) Prof. H. Tanner, MD

Institutes

The student is given the opportunity to work on a highly innovative project, involving the following institutions:

- Department of Cardiology, Inselspital, Bern University Hospital
- ARTORG Cardiovascular Engineering, University of Bern
- Institute for Human Centered Engineering – Microlab, Bern University of Applied Sciences, Biel

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